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13MCA41

Fourth Semester MCA Degree Examination, Dec.2017/Jan.2018

Analysis and Design of Algorithms

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Mention the general plan for analyzing the efficiency of recursive algorithm. Apply this plan to analyze the algorithm to solve tower of Hanoi problem. (10 Marks)
- b. Define space and time complexities. Explain the commonly used asymptotic notations with an example for each. (10 Marks)
- 2 a. Compare the orders of growth of $\frac{1}{2}n(n-1)$ and n^2 using limits. (04 Marks)
- b. Write the algorithm for selection sort and analyze the time complexity of the algorithm. (06 Marks)
- c. Explain the general divide and conquer technique. Discuss merge sort algorithm and analyze the same. (10 Marks)
- 3 a. Write the algorithm for Quick Sort and trace the algorithm on the following data: 5, 3, 1, 9, 8, 2, 4, 7. (10 Marks)
- b. Write the recursive binary search algorithm and apply it for searching 70 in the following list: 3, 14, 27, 31, 39, 42, 55, 70, 74, 81, 85, 93, 98. (10 Marks)
- 4 a. Explain the methods used for topological ordering of vertices of a Directed Acyclic Graph. Apply any one of the methods on the graph given in Fig.Q4(a) and write the sorted list of vertices.

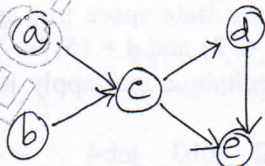


Fig.Q4(a) (10 Marks)

- b. Explain decrease and conquer technique and its major variants. Traverse the graph given in Fig.Q4(b) using BFS method.

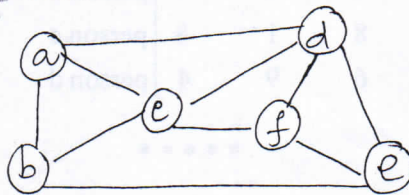


Fig.Q4(b) (10 Marks)

- 5 a. Explain Horspool's algorithm to find the pattern in the given text and search for the pattern BARBER. Text : JIM\$SAW\$ME\$IN\$A\$BARBER\$SHOP (10 Marks)
- b. Apply Dynamic Programming technique to the following instance of KnapSack problem, capacity, $W = 5$.

| Item | Weight | Value |
|------|--------|-------|
| 1 | 2 | 12 |
| 2 | 1 | 10 |
| 3 | 3 | 20 |
| 4 | 2 | 15 |

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 6 a. Explain Dynamic Programming. Explain Warshall's algorithm and find the transitive closure of the following graph in the Fig.Q6(a).

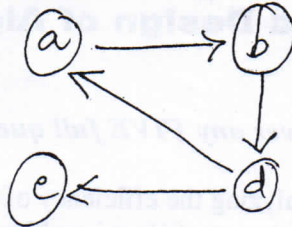


Fig.Q6(a)

(10 Marks)

- b. Write Prim's algorithm. Apply this algorithm to find minimum cost spanning tree of the graph shown in Fig.Q6(b).

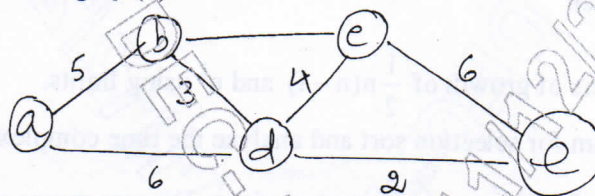


Fig.Q6(b)

(10 Marks)

- 7 a. Explain Huffman's algorithm and construct Huffman tree for the following data and obtain the Huffman codes.

| Character | A | B | C | D | E |
|-------------|------|-----|-----|-----|------|
| Probability | 0.35 | 0.1 | 0.2 | 0.2 | 0.15 |

(10 Marks)

- b. Write short notes on the following:

- i) Decision tree
- ii) P, NP and NP complete problems

(10 Marks)

- 8 a. Explain backtracking. Draw the state space tree and solve the subset sum problem for the following instance. $S = \{3, 5, 6, 7\}$ and $d = 15$.

(10 Marks)

- b. Explain branch and bound technique and apply it to assignment problem specified in the following cost matrix, C.

| | job1 | job2 | job3 | job4 | |
|-----|------|------|------|------|----------|
| C = | 9 | 2 | 7 | 8 | person a |
| | 6 | 4 | 3 | 7 | person b |
| | 5 | 8 | 1 | 8 | person c |
| | 7 | 6 | 9 | 4 | person d |

(10 Marks)
